Claims

We claim:

1. An optical wavelength standard, comprising:

a diffraction grating comprising a diffractive surface;

an input optical arrangement located to illuminate the diffractive surface of the diffraction grating with incident light at an angle of incidence at which absorption of the incident light at a resonance wavelength generates surface plasmons; and

an output optical arrangement located to receive the incident light specularly reflected by the diffractive surface of the diffraction grating as reflected light, the reflected light including an absorption line at the resonance wavelength.

2. The optical wavelength standard of claim 1, in which the diffractive surface comprises metal.

3. The optical wavelength standard of claim 1, in which:

the optical wavelength standard additionally comprises an auxiliary light source operable to generate the incident light in a range of wavelengths spanning the resonance wavelength; and

the input optical arrangement comprises an optical fiber arranged to receive the incident light from the auxiliary light source and to direct the incident light towards the diffractive surface.

4. The optical wavelength standard of claim 3, in which the input optical arrangement additionally comprises a collimator and a polarizer arranged in series between an end of the optical fiber remote from the auxiliary light source and the diffractive surface of the diffraction grating.

5. The optical wavelength standard of claim 1, in which the input optical arrangement comprises an optical fiber, a collimator and a polarizing element arranged in series.

6. The optical wavelength standard of claim 1, in which the output arrangement comprises a focusing element and an optical fiber arranged in series.

7. The optical wavelength standard of claim 1, in which:

the input optical arrangement is a first input optical arrangement, the output optical arrangement is a first output optical arrangement, the angle of incidence is a first angle of incidence and the resonance wavelength is a first resonance wavelength; and

the optical wavelength standard additionally comprises:

a second input optical arrangement located to illuminate the diffractive surface of the diffraction grating with incident light at a second angle of incidence at which absorption of the incident light at a second resonance wavelength generates surface plasmons; and

a second output optical arrangement located to receive the incident light specularly reflected by the diffractive surface at an angle of reflection equal to the second angle of incidence as reflected light, the reflected light including an absorption line at the second resonance wavelength.

8. The optical wavelength standard of claim 1, in which the input optical arrangement is connected to receive light subject to calibration as the incident light.

9. An optical calibration system for calibrating the wavelength of light subject to calibration generated by a light source subject to calibration at a wavelength determined by a control signal, the system comprising:

an auxiliary light source operable to generate the incident light in a wavelength range spanning the resonance wavelength;

the optical wavelength standard of claim 1, in which the input optical arrangement is arranged to receive the incident light from the auxiliary light source; and an optical calibration apparatus arranged to receive the light subject to calibration and additionally to receive the reflected light from the output optical arrangement, the optical calibration apparatus operable to perform a wavelength comparison between the absorption line in the reflected light and the light subject to calibration and to

provide the control signal to the light source subject to calibration, the control signal representing a wavelength difference between absorption line and the light subject to calibration.

10. The optical calibration system of claim 9, in which the optical calibration apparatus is configured to determine a wavelength difference between the absorption peak and the light subject to calibration and to generate the control signal to reduce the wavelength difference to a predetermined difference.

11. The optical calibration system of claim 10, in which the predetermined difference is zero.

12. An optical calibration system for calibrating the wavelength of light subject to calibration generated by a light source subject to calibration at a wavelength controlled by a control signal, the system comprising:

the optical wavelength standard of claim 1 in which the input optical arrangement is arranged to receive from the light source subject to calibration the light subject to calibration as the incident light; and

an optical calibration apparatus arranged to receive the reflected light from the output optical arrangement, the optical calibration apparatus operable to generate the control signal in response to the intensity of the reflected light and to provide the control signal to the light source subject to calibration.

13. The optical calibration system of claim 12, in which the optical calibration apparatus is configured to generate the control signal to the wavelength of the light subject to calibration to set the intensity of the reflected light to a predetermined relationship to a minimum of the intensity.

14. The optical calibration system of claim 13, in which the predetermined relationship is equality.

15. A calibration method for calibrating the wavelength of light subject to calibration, the method comprising:

providing a diffraction grating comprising a diffractive surface;

specularly reflecting incident light off the diffractive surface of the diffraction grating light at an angle of incidence at which absorption of the incident light at a resonance wavelength generates surface plasmons;

receiving the light reflected by the diffractive surface as reflected light, the reflected light having an absorption line at the resonance wavelength; and

calibrating the wavelength of the light subject to calibration using the absorption line in the reflected light as a wavelength reference.

16. The method of claim 15, in which the calibrating comprises:

determining a wavelength difference between the absorption line in the reflected light and the light subject to calibration; and

changing the wavelength of the light subject to calibration in response to the wavelength difference.

17. The method of claim 15, in which the reflecting comprises illuminating the diffractive surface of the diffraction grating with light in a wavelength range spanning the resonance wavelength as the incident light.

18. The method of claim 17, in which the calibrating comprises:

determining a wavelength difference between the absorption line in the reflected light and the light subject to calibration; and

setting the wavelength of the light subject to calibration in response to the wavelength difference.

19. The method of claim 18, in which the setting comprises changing the wavelength of the light subject to calibration to set the wavelength difference to a predetermined wavelength difference.

20. The method of claim 19, in which the predetermined difference is zero.

21. The method of claim 19, in which the reflecting comprises illuminating the diffractive surface with the light subject to calibration as the incident light.

22. The method of claim 21, in which the calibrating comprises:

measuring the intensity of the reflected light; and

setting the wavelength of the light subject to calibration to establish a predetermined relationship between the measured intensity and minimum of the measured intensity.

23. The method of claim 22, in which the predetermined relationship is equality.